



SILICON

CAS number: 7440-21-3

Synonyms: —

Chemical formula: Si

Workplace exposure standard (interim)

TWA: 10 mg/m³

STEL: —

Peak limitation: —

Notations: —

IDLH: —

Sampling and analysis: The recommended value is quantifiable through available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 10 mg/m³ is recommended to protect for chronic respiratory conditions in exposed workers.

Given the limited data available from the primary sources, it is recommended that a review of additional sources be conducted at the next scheduled review.

Discussion and conclusions

Silicon is used in the manufacture of electronics, alloys and polymers.

The critical effect of exposure is chronic bronchitis.

The toxicological database is extremely limited. Epidemiological data indicate that critical effects are likely due to non-substance-specific effects arising from exposure to nuisance dusts (ECHA, 2020). Pulmonary pneumoconiosis is evidenced only at high acute exposures when administered as intratracheal instillations in animals (HCOTN, 2002).

The exposure data in the available source material are insufficient to recommend a health-based OEL (HCOTN, 2002). However, epidemiological data indicate the substance is inert under workplace conditions and effects of exposure are attributable to nuisance dust effects.

In the absence of quantitative human or animal exposure data, the TWA of 10 mg/m³ is recommended be retained in the interim and further assessment of additional source material is recommended during subsequent reviews.

Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Not classified as a skin sensitizer or respiratory sensitizer according to the GHS.

There are insufficient data to recommend a skin notation.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	1991	TWA: 10 mg/m³
ACGIH	NA	NA
No report; previous TLV-TWA of 10 mg/m ³ withdrawn (HCOTN, 2002)		
DFG	NA	NA
No report. ECHA (2020) states: “DNEL based on DFG (2014) MAK for inert dust, 4 mg/m ³ ”		
SCOEL	NA	NA
No report		
OARS/AIHA	NA	NA
No report		
HCOTN	2002	TWA: 10 mg/m³
Summary of information: Toxicological database is too limited to recommend a HBROEL) and there is insufficient information to comment on the suitability of the current administrative OEL. Very low likelihood of occupational exposure to elemental silicon due to its high reactivity, which typically forms silica under workplace conditions. No target organ can be determined from the available animal studies. Human data: - Dose-dependent cell necrosis <i>in vitro</i> in foetal lung cells at 50–150 µg/mL. Animal data: - Intratracheal instillation studies results: - pulmonary pneumoconiosis at 50 mg (rats); nodules in lungs after 3 mo, increased lung weight, formation of dust foci and bronchitis after 12 mo - slight pulmonary epithelial lesions after 12 mo at 25 mg (rabbits) - toxicity of silicon dust considered lower than that of quartz dust - Increased levels of glycogen and decreased lactate levels in cornea at 1.55 mg/m³ and 7 cal/cm² of radiant heat (Arc Thermal Performance Value (ATPV)) (rats, 2–8 mo, no further information provided) - No signs of toxicity at 100–200 mg/animal in long-term repeat injection study (rats, guinea pigs, no further details on duration and administration route provided); cited article notes cellular changes typical of inert responses (no further information provided) - Increased lipid peroxidation in lung and liver and blood albumin modification following intratracheal instillation of 50 mg of welding dust containing 2–20% Si and other elements (rats); haematological and metabolic changes (not specified) in cardiac respiratory system at 12.5 mg/kg/d of dust (rats, 1 mo) - No ADME, mutagenicity or carcinogenicity data available for assessment.		

Secondary source reports relied upon

Source	Year	Additional information
NICNAS	* 2018	Tier I: no assessment.
ECHA	✓ 2020	- No substance-specific repeat inhalation data available, DNEL based on DFG (2014) MAK for inert dust, 4 mg/m³ - Epidemiological study of silicon/ferrosilicon manufacturing industry showed exposure is associated with increased risk of chronic bronchitis, consistent with exposure to other inert dusts, but no excess mortality from cancer or respiratory diseases: - study limited due to mixed exposures to other compounds present in dust in such manufacturing conditions.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic? Insufficient data

Is the chemical carcinogenic with a mutagenic mechanism of action? Insufficient data

Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	—
HCIS	NA
NICNAS	NA
EU Annex	NA
ECHA	—
ACGIH	NA
DFG	NA
SCOEL	NA
HCOTN	—
IARC	NA
US NIOSH	NA

NA = not applicable (a recommendation has not been made by this Agency); — = the Agency has assessed available data for this chemical but has not recommended any notations

Skin notation assessment

Calculation

Insufficient data to assign a skin notation.

IDLH

Is there a suitable IDLH value available? No

Additional information

Molecular weight:	28.0855
Conversion factors at 25°C and 101.3 kPa:	1 ppm = Number mg/m ³ ; 1 mg/m ³ = Number ppm
This chemical is used as a pesticide:	☐
This chemical is a biological product:	☐
This chemical is a by-product of a process:	☐
A biological exposure index has been recommended by these agencies:	☐ ACGIH ☐ DFG ☐ SCOEL

Workplace exposure standard history

Year	Standard
Click here to enter year	

References

Health Council of the Netherlands (HCOTN) (2002) Silicon. Health-based calculated occupational cancer risk values. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/054.

European Chemicals Agency (ECHA) (2020) Silicon – REACH Assessment.